

1 OCTOBER 1998



Civil Engineering

**HEATING SYSTEMS AND UNFIRED
PRESSURE VESSELS**

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OPR: HQ AFCESA/CESM
(Mr. Gerald E. Doddington)
Supersedes AFI 32-1068, 6 May 1994

Certified by: HQ AFCESA/CC
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Pages: 17
Distribution: F

This instruction implements AFPD 32-10, *Installations and Facilities*, by establishing uniform requirements for installation, operation, maintenance, and inspection of real property installed equipment (RPIE) heating systems and unfired pressure vessels. It applies only to pressure vessels covered by the boiler and pressure vessel code of the American Society of Mechanical Engineers (ASME). It does not apply to low pressure boilers below 0.29 megawatts (MW) (1 million British thermal units per hour [MBtu/h]) output used only for domestic water heating; or pressure vessels containing noncorrosive refrigerants. Users should send comments and suggested improvements on AF Form 847, Recommendation for Change of Publication, through major commands (MAJCOM) and HQ AFCESA, 139 Barnes Drive, Suite 1, Tyndall AFB FL 32403-5319 to HQ USAF/ILEO, 1260 Air Force Pentagon, Washington DC 20330-1260. [Attachment 1](#) lists references, and supporting information.

SUMMARY OF REVISIONS

This document is substantially revised and must be completely reviewed.

This is the first revision to AFI 32-1068, including responsibilities for the Chief of Engineering; substantially revising coal ordering procedures; clarifying boiler operator attendance and maintenance of distribution systems; and adding categories of inspection for unfired pressure vessels. This update rescinds ETL 88-6, *Heat Distribution Systems Outside Buildings*. This revision makes AF Form 288 obsolete and RCS: HAF-CE(A) 8301, Request for Boiler Inspection, is no longer required. This revision prescribes AF Form 1222, Boiler or Pressure Vessel Inspection Report and DD Form 416, Purchase Request for Coal, Coke or Briquettes.

1. Objective. Air Force heating systems and unfired pressure vessels must be safe, reliable, and efficient. Build and operate these systems to comply with the ASME Boiler and Pressure Vessel Code, and conform to Federal law.

2. Responsibilities:**2.1. HQ AFCESA:**

- 2.1.1. Formulates Air Force instructions and guidance for maintaining heating systems and unfired pressure vessels.
- 2.1.2. Directs implementation of applicable public law, safety standards, and Department of Defense directives.
- 2.1.3. Provides technical assistance to MAJCOMs.

2.2. MAJCOM:

- 2.2.1. Gives management and technical assistance to Base Civil Engineer organizations.
- 2.2.2. Helps bases determine fuel requirements and proper applications.
- 2.2.3. Overseas: Provides solid fuel requisition procedures for overseas bases.
- 2.2.4. Approves mixing and burning of waste fuel and lubricants with heating fuel.
- 2.2.5. Manages the boiler inspection program for bases within the command.
- 2.2.6. Approves heating fuel or equipment conversion proposals.
 - 2.2.6.1. Ensures proposal is complete and economic analysis complies with the Energy Conservation Investment Program (ECIP) procedures.
 - 2.2.6.2. Coordinates economic analysis and approval with HQ AFCESA.
- 2.2.7. Approves repairs to boiler pressure vessel components, fuel, and controls systems.
- 2.2.8. Approves temporary repairs to distribution systems.

NOTE:

Air National Guard (ANG) will provide guidance to ANG installations where variations from this instruction are necessary.

2.3. Base Civil Engineer:

- 2.3.1. Appoints an engineer or appropriate supervisor to interpret and ensure compliance with applicable codes and Federal law.

2.4. Chief of Operations:

- 2.4.1. Operates and maintains base heating and distribution systems and unfired pressure vessels covered by this instruction.
- 2.4.2. Determines liquid, solid, and gas utility fuel requirements and ensures safety and adequacy of fuel supplies.
- 2.4.3. Establishes and maintains a recurring maintenance program for heating and pressure vessel systems.
- 2.4.4. Establishes and maintains a base steam trap maintenance program.
- 2.4.5. Develops and maintains local operating procedures.

- 2.4.6. Maintains operating logs and records of repairs to boilers.
- 2.4.7. Develops schedules for inspection and testing of heating systems and unfired pressure vessels and ensures equipment is reliable and safe.
- 2.4.8. Processes and posts inspection reports, and reports unsafe boilers or pressure vessels to the MAJCOM.
- 2.4.9. Establishes a program to measure systems performance and make continuous improvements.
- 2.4.10. Metrics from this program will be reviewed periodically by the Base Civil Engineer.
- 2.4.11. Assigns properly trained, experienced personnel.
- 2.4.12. Ensures heat plant operating personnel are licensed to meet state and U.S. Environmental Protection Agency (USEPA) requirements.
- 2.4.13. Ensures system effluents conform to applicable standards.
- 2.4.14. Ensures waste is burned in approved furnaces only.
- 2.5. Chief of Maintenance Engineering:
 - 2.5.1. Programs and accomplishes approved repairs or alterations.
 - 2.5.2. Ensures all boilers, pressure vessels, and pressure piping systems installed, repaired or replaced by the Operations Flight meet American Society of Mechanical Engineers (ASME) requirements.
 - 2.5.3. Develops cost-effective alternatives for system and equipment monitoring, where feasible.
- 2.6. Chief of Engineering and Construction:
 - 2.6.1. Ensures all boilers, pressure vessels, and pressure piping systems installed, repaired or replaced by the Engineering Flight meet American Society of Mechanical Engineers (ASME) requirements
 - 2.6.2. Ensures all boiler fuel piping and controls meet National Fire Protection Association (NFPA) requirements.
 - 2.6.3. Ensures all construction projects involving heat plants and distribution systems comply with requirements of this instruction and environmental permits and regulations.

3. Requirements:

- 3.1. Fuel Conversion. Public law requires Air Force heating systems use the most cost-effective fuel, determined by life cycle cost analysis. Evaluate fuel suitability, availability, environmental impact, reliability, and maintainability when considering fuel conversion. Use ECIP Program discount rates, fuel escalation rates, and life cycle cost analysis.
- 3.2. Solid Fuels:
 - 3.2.1. Requisitions. Prepare DD Form 416, Purchase Request for Coal, Coke, or Briquettes, and submit to Defense Energy Support Center (DESC), DESC-AC, 8725 John J. Kingman Road, Suite 4950, Ft Belvoir, VA 22060-6222 according to dates and instructions specified by DESC. Requisition and acceptance procedures for overseas bases shall be provided by the MAJCOM.

3.2.1.1. Placing Orders. DD Form 1155 must be submitted IAW DESC instructions and at least 30 days prior to the desired delivery date.

3.2.2. Accepting Deliveries. Before accepting a delivery, central heat plant personnel must inspect each shipment prior to unloading and at the point and time of delivery, according to the DESC contract for the base. Send out samples of the coal shipment for analysis according to the DESC contract for the base.

3.2.2.1. Sampling. Heat plant personnel must take coal samples according to the DESC contract for the base, and attach a completed AF Form 119, Coal Sample Identification.

3.2.2.2. Non-Conforming Coal. The coal sampler notifies the Chief of Operations when a coal delivery does not comply with the contract, and recommends rejection to DESC-AC.

NOTE:

The DESC Contracting Officer is the final authority for rejecting a coal shipment.

3.2.3. Inspecting Coal Stockpiles. Heat plant personnel must inspect coal stockpiles at least twice weekly. Investigate abnormally high temperatures or signs of spontaneous combustion. Use a temperature probe (or other proven method) to measure internal temperature. If internal temperature rises above 71 °C (160 °F), coal may ignite.

3.3. Liquid Fuels. Obtain MAJCOM approval before mixing and burning waste fuel and lubricants with heating fuel.

3.3.1. Requisitions. Submit liquid fuel requirements for each fiscal year to the base fuels management office (FMO).

3.3.2. Accepting Deliveries. When fuel is delivered to a tank assigned to the Base Civil Engineer (for overseas, all heating fuel tanks they maintain), the Base Civil Engineer furnishes escort personnel if directed by the installation commander. (Refer to AFI 23-204, *Organizational Fuel Tanks*).

3.3.3. Sampling. Fuel sampling is the responsibility of the receiving organization. The Base Civil Engineer will periodically take samples of fuel received into tanks to assure specification quality per Technical Order (TO) 42B-1-1. Frequency will be based on historical experience with the supplier but will be no less than one sample per month per type fuel. Obtain MAJCOM approval before mixing and burning waste fuel and lubricants with heating fuel.

3.4. Process Steam. Where possible, supply process steam which wastes condensate (such as steam cleaning) from dedicated boilers.

3.5. Heating and Distribution Systems and Unfired Pressure Vessels. Design and construction of steam boilers, hot water generators, heating and distribution systems, unfired pressure vessels, and pressure piping systems must comply with ASME code and requirements of this instruction. Design of all steam and hot water heating systems must include equipment to provide industrial water treatment (AFI 32-1054, *Corrosion Control*). Equip all boilers and unfired pressure vessels with a pressure-relieving device as required by the applicable section and paragraph of the ASME code. Equip all steam pressure-reducing valve stations on the low-pressure side with a correctly rated and sized pressure relief device. Compressed air receivers less than 0.04 cubic meters (1.5 cubic feet) must

have the manufacturer's standard pressure relieving device. All pressure vessels in which moisture can accumulate must have automatic condensate drainage.

3.5.1. Attendance. **Table 1.** presents recommended minimum attendance of operating technicians at facilities or heat plants having single or multiple steam boilers and/or hot water generators with typical total capacities and pressures. Operating technicians must be able to detect and correctly respond to equipment malfunctions or irregularities that could disrupt service, cause a hazard, or damage equipment. Plant personnel must be licensed to meet environmental regulatory agency requirements. Recommend all steam boilers operating at or above 103 kPa (15 psig), or hot water generators operating at or above 207 kPa (30 psig) which are not constantly attended, be monitored from a remote location manned full-time by a system-trained technician with capability to safely shut down units. Remote monitoring shall not override (prevent) any boiler or hot water generator safety shutdown. Variances to **Table 1.** must be approved by the MAJCOM.

Table 1. Recommended Minimum Boiler Attendance ¹

Heating-Medium	Total Boiler Capacity²	Operating Pressure and Temperature	Fuel	Frequency of Attendance
Hot Water	under 1.465 MW (5,000,000 Btuh/h)	under 207 kPa (30 psig) and 121 °C (250 °F)	all energy sources	once every month during operation ³
	over 1.465 MW (5,000,000 Btuh/h)	under 207 kPa (30 psig) and 121°C (250 °F)	all energy sources	once every day during operation ³
	under 1.465 MW (5,000,000 Btuh/h)	207-1103 kPa (30-160 psig) 121-177 °C (250-350 °F)	all energy sources	once per 8-hour shift during operation ³
	1.465 MW (5,000,000 Btuh/h) to 8.8 MW (30,000,000 Btuh/h)	207-1103 kPa (30-160 psig) 121-177 °C (250-350 °F)	all energy sources	twice per 8-hour shift during operation ³
	8.8 MW (30,000,000 Btuh/h) to 29.3 MW (100,000,000 Btuh/h)	207-1103 kPa (30-160 psig) 121-177 °C (250-350 °F)	all energy sources ⁴	constant attendance one person per 8-hour shift ⁵
	over 29.3 MW (100,000,000 Btuh/h)	207-1103 kPa (30-160 psig) 121-177 °C (250-350 °F)	all energy sources ⁴	constant attendance two people per 8-hour shift
	under 8.8 MW (30,000,000 Btuh/h)	over 1103 kPa (160 psig) over 177 °C (350 °F)	all energy sources	twice per 8-hour shift during operation ³
	8.8 MW (30,000,000 Btuh/h) to 29.3 MW (100,000,000 Btuh/h)	over 1103 kPa (160 psig) over 177 °C (350 °F)	all energy sources ⁴	constant attendance two people per 8-hour shift ⁵
	over 29.3 MW (100,000,000 Btuh/h)	over 1103 kPa (160 psig) over 177 °C (350 °F)	all energy sources ⁴	constant attendance two people per 8-hour shift
Steam	under 0.293 MW (1,000,000 Btuh/h)	under 103 kPa (15 psig)	all energy sources	once every week during operation ³
	0.293 MW (1,000,000 Btuh/h) to 1.465 MW (5,000,000 Btuh/h)	under 103 kPa (15 psig)	all energy sources	twice per week during operation ³
	over 1.465 MW (5,000,000 Btuh/h)	under 103 kPa (15 psig)	all energy sources	once per operating day ³

	under 1.465 MW (5,000,000 Btuh/h)	over 103 kPa (15 psig)	all energy sources	once per 8-hour shift during operation ³
	1.465 MW (5,000,000 Btuh/h) to 8.8 MW (30,000,000 Btuh/h)	over 103 kPa (15 psig)	all energy sources ⁴	twice per 8-hour shift during operation ³
	8.8 MW (30,000,000 Btuh/h) to 29.3 MW (100,000,000 Btuh/h)	over 103 kPa (15 psig)	all energy sources ⁴	constant attendance two people per 8-hour shift ⁵
	over 29.3 MW (100,000,000 Btuh/h)	over 103 kPa (15 psig)	all energy sources ⁴	constant attendance two people per 8-hour shift

Notes:

1. Attendance at a lesser frequency than listed in the table must be approved by the MAJCOM.
2. The sum of the rated capacities of all boilers and hot water generators in the facility.
3. Frequency of attendance does not include time for performance of maintenance tasks.
4. For coal-fired plants, additional operating personnel are required for coal and ash handling consistent with installed equipment.
5. Attendance can be reduced by one person per 8-hour shift only if boiler controls and safeties are automated and continuously monitored by a system-trained technician from a remote location with capability of safe shutdown of all units.

3.5.2. Operating Logs. Heat plant logs give supervisory and management personnel a summary of boiler plant operation and establish a basis for environmental air quality permits. Use AF Form 1163, Monthly High Temperature Water Distribution System Operating Log; AF Form 1165, Monthly High Temperature Water Plant Operating Log; AF Form 1458, Daily Steam Boiler Plant Operating Log; AF Form 1459, Water Treatment Operating Log for Steam and Hot Water Boilers; and AF Form 1464, Monthly Steam Boiler Plant Operating Log, for this purpose. Computer-generated printouts are acceptable if they contain all pertinent information. The heat plant foreman or zone maintenance chief must maintain boiler plant performance and operating logs for the following boilers:

3.5.2.1. High pressure, over 103 kPa (15 psig) steam and 121 °C (250 °F).

3.5.2.2. 1103 kPa (160 psig) high temperature water (HTW) boiler plant with output capacity of 0.41 MW (1.4 MBtu/h) or more.

3.5.2.3. Low pressure boiler plant with output of 1.41 MW (4.8 MBtu/h).

The Base Civil Engineer sends operating logs for high pressure plants 4.1 MW (14 MBtu/h) or larger to the MAJCOM (if required by the MAJCOM). The MAJCOM should receive the logs by the 20th of each month.

3.5.3. Maintenance. At dual fuel plants, fire boilers at least bimonthly with standby fuel to confirm reliability. Overhaul equipment and accomplish other major maintenance during off-peak periods. Calibrate boiler instrumentation annually. See that replacement materials and parts comply with boiler code safety standards. Maintain equipment ASME code stamps and labels in legible condition. The Base Civil Engineer must ensure that scheduled maintenance of boilers, heating equipment, and steam traps is performed.

3.5.3.1. Pressure Vessel Welding. Weld according to the ASME Boiler and Pressure Code, Section IX, Welding and Brazing Qualifications, which contains welding procedural specifications and welder qualification requirements. Do not weld or braze pressure components of steam-jacketed cooking equipment; replace failed parts.

3.5.3.2. Distribution Systems. Perform maintenance according to the manufacturer's recommendations.

3.5.3.2.1. Existing Systems. At least annually, pressure test outer conduit of direct burial systems (with pressure-test capability). Pressure test the outer conduit at 103 kPa (15 psig) for 24 hours. Record results in a permanent log; include a summary of events and final analysis.

3.5.3.2.2. Failed Distribution Lines. Make temporary repairs to failed lines as soon as conditions permit. Program replacement of failed sections as soon as the extent of failure is known. Notify the MAJCOM when you are considering replacement.

3.5.3.2.3. Temporary Repairs. Temporary repairs to direct buried systems using piping other than prefabricated conduit systems are permitted. Limit these repairs to 152.4 meters (500 feet) per repair, and replace these repairs within 18 months with an approved system and materials. Repair material must be suitable for use under pressure and temperature conditions of the distribution system being repaired.

3.5.4. Replacement Distribution Lines. Before replacing failed lines, select a route, then a system type.

3.5.4.1. Route Selection. The system route should be coordinated with the facility master plan. The route selected has considerable impact on system type selection. For example, aboveground systems usually are not acceptable if they create obstructions to traffic or are unsightly. Large numbers of obstructions along the system profile greatly increase the cost of underground systems. Attention should be given to any severe or complex installation conditions which adversely affect the cost of the system. The final route selected should minimize system life cycle cost.

3.5.4.2. System Type Selection. Select heat distribution system types according to the following order of preference:

- (1) aboveground
- (2) shallow concrete trench
- (3) direct buried prefabricated conduit.

Make a selection from among practical alternatives based on the results of a life cycle cost analysis. Note: Recent studies by the U.S. Army Construction Engineering Research Labora-

tory (USACERL) indicate, in general, life cycle cost is lower for shallow concrete trench than direct burial systems.

3.5.5. New Systems. Test new direct burial systems that you can pressure-test, drain, and dry when you accept them. Pressure test the outer conduit at 103 kPa (15 psig) for a period of 24 hours. Test at least once a year thereafter. Promptly send results of tests to the MAJCOM and HQ AFCEA for evaluation.

3.5.6. Guidelines for New or Replacement Systems. Guide specifications for design and installation for new or replacement distribution lines are available in the Construction Criteria Base (CCB). Refer to [Attachment 1](#) for the appropriate guide specifications for design and installation of new or replacement distribution lines.

3.5.7. Inspections and Testing:

3.5.7.1. Methods and Criteria:

3.5.7.1.1. The United States, Its Territories and Possessions. Inspect boilers and unfired pressure vessels according to the National Board Inspection Code (NBIC).

3.5.7.1.2. Foreign Countries. Inspect boilers according to host country agreement or standards if comparable (minimally) to the NBIC. Otherwise, follow the NBIC guidelines.

3.5.7.2. Boilers and Fired Pressure Vessels. Inspect high pressure steam boilers (above 103 kPa [15 psig]), and HTW generators (above 1103 kPa [160 psig] or 121 °C [250 °F]) and expansion tanks in active use. Inspections must be performed by a certified inspector (paragraph A2.2.8). See [Attachment 2](#) for a description of inspection types and scheduling guidelines. A certified inspector is not required for inspection of:

3.5.7.2.1. Steam boilers with safety valves set at 103 kPa (15 psig) or less.

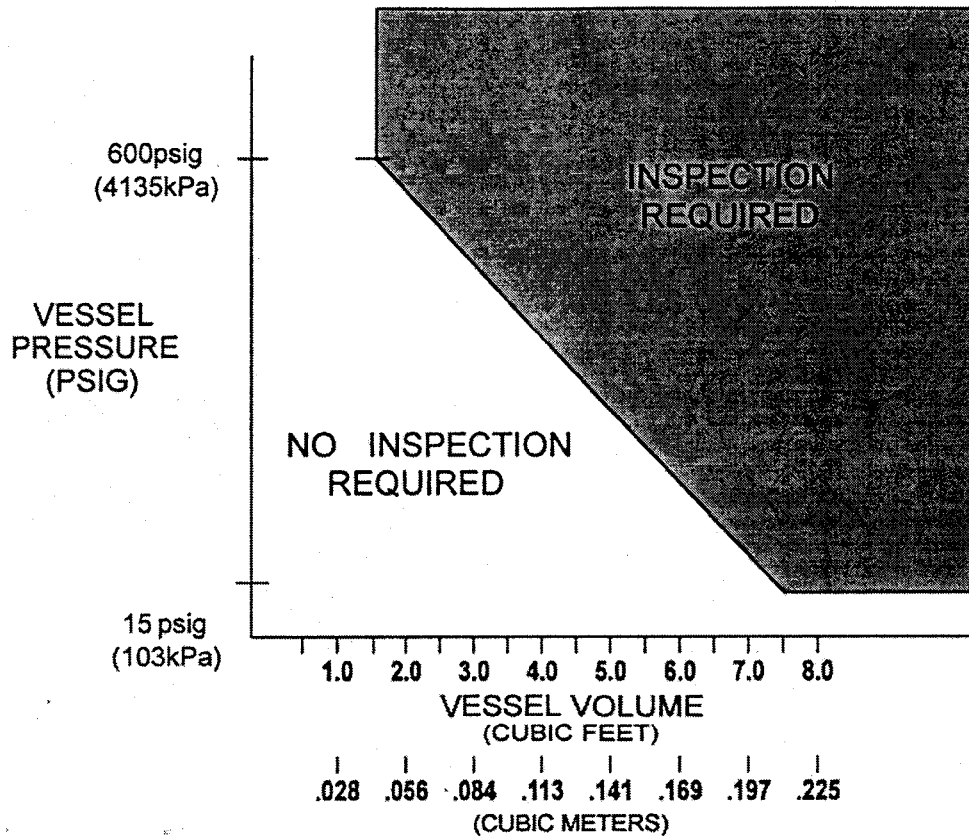
3.5.7.2.2. Hot water boilers with safety valves set at 310 kPa (45 psig) or less.

3.5.7.2.3. Pressure vessels of less than 9818 W (33,500 Btu/h) specially constructed for laboratory purposes.

3.5.7.3. Steam-Jacketed Cooking Equipment. Inspect steam kettles and other steam-jacketed cooking equipment according to manufacturer's instructions; or hydrostatically test once every three years.

3.5.7.4. Unfired Pressure Vessels. Every three years, inspect unfired pressure vessels internally and externally that operate with pressures and vessel volumes in the shaded area of [Figure 1](#). Inspect unfired steam pressure vessels which operate at pressures above 103 kPa (15 psig). Perform a hydrostatic test to 1.5 times working pressure every 3 years on vessels operating above 1379 kPa (200 psig) that cannot be inspected internally and externally. Inspections are not required on water storage and domestic hot water storage tanks.

Figure 1. Unfired Pressure Vessel Inspection.



3.5.7.5. Reporting Inspections. Report all boiler and pressure vessel inspections on AF Form 1222, Boiler or Pressure Vessel Inspection Report. Promptly notify the MAJCOM when a boiler or pressure vessel is unsafe to operate. The MAJCOM may issue separate reporting instructions. Post one copy of the inspection report (under transparent protective cover) in a conspicuous location near the boiler or pressure vessel; send one copy to Maintenance Engineering; put one copy in the file.

3.5.7.6. Post-Inspection Repairs. Before leaving the base, the inspector orally reports any serious defects to the Chief of Operations. Make corrective actions called for by the inspector or listed on the inspection reports. If a boiler or pressure vessel is unsafe to operate, make proper repairs before placing it on-line. All repairs to pressure components of boilers or unfired pressure vessels and safety pressure relief devices must be performed by an organization holding the appropriate ASME code stamp.

3.5.7.7. Reporting Repairs. After inspection of repairs (paragraph A2.2.4), post one copy of the inspection report describing repair actions (under transparent protective cover with the original inspection report); send one copy to Maintenance Engineering; put one copy in the file.

3.6. Privately Owned Boilers. Privately owned boilers located on Air Force installations must be operated safely. Contract QAE shall monitor these boilers to ensure the operator:

- 3.6.1. Complies with basic safety practices similar to those required of Government boilers.
- 3.6.2. Arranges for periodic safety inspections.
- 3.6.3. Has an authorized inspection agency inspect at the same intervals required for Government boilers.
- 3.6.4. Posts inspection reports as specified for Government-operated boilers.

NOTE:

The boiler operator must: (1) Make repairs that the inspector recommends; (2) pay for all inspections and repairs; not operate a boiler before repairing it if the inspector declares it unsafe. Repair boilers according to the NBIC or host-country code, as applicable.

4. Forms Prescribed. AF Forms 119, **Coal Sample Identification**, 1163, **Monthly High Temperature Water Distribution System Operating Log**, 1165, **Monthly High Temperature Water Plant Operating Log**, 1222, **Boiler or Pressure Vessel Inspection Report**, 1458, **Daily Steam Boiler Plant Operating Log**, 1459, **Water Treatment Operating Log for Steam and Hot Water Boilers**, 1464, **Monthly Steam Boiler Plant Operating Log**; and DD Form 416, **Purchase Request for Coal, Coke, or Briquettes**.

WILLIAM P. HALLIN, Lt Gen, USAF
DCS/Installations & Logistics

Attachment 1**GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References*****Air Force Publications**

AFI 23-204, *Organizational Fuel Tanks*

AFI 32-1054, *Corrosion Control*

TO 42B-1-1, *Quality Control of Fuels and Lubricants*

Corps of Engineer Guide Specifications

CEGS 02552, Section 02552, *Preengineered Underground Heat Distribution Systems*

CEGS 02554, Section 02554, *Aboveground Heat Distribution Systems*

CEGS 02555, Section 02555, *Prefabricated Underground Heating / Cooling Distribution System*

CEGS 02696, Section 02696, *Heat Distribution Systems in Concrete Trenches*

Naval Facilities Engineering Command Guide Specifications

NFGS 02693F, Section 02693F, *Exterior Shallow Trench Heat Distribution System*

NFGS 02694H, Section 02694H, *Exterior Underground Heat Distribution System*

NFGS 02695J, Section 02695J, *Exterior Aboveground Steam Distribution System*

NFGS 02697F, Section 02697F, *Exterior Buried Pumped Condensate Return System*

NFGS 02698K, Section 02698K, *Exterior Buried Preinsulated Water Piping*

Other:

ASME, *Boiler and Pressure Code*

NBIC, *National Board Inspection Code National Board of Boiler & Pressure Vessel Inspectors*, 1055 Crupper Ave., Columbus, OH 43229-1183

Abbreviations and Acronyms

AFCESA—Air Force Civil Engineer Support Agency

AFPD—Air Force Policy Directive

ASME—American Society of Mechanical Engineers

CCB—Construction Criteria Base

CONUS—Continental United States

DESC—Defense Energy Support Center

ECIP—Energy Conservation Investment Program

EMCS—energy management and control system

FMO—Fuels Management Office

HTW—high temperature water

kPa—kilopascal

MAJCOM—major command

Mbtu/h—million British thermal units per hour

MW—megawatt

NBIC—National Board Inspection Code

NFPA—National Fire Protection Association

OCONUS—Outside Continental United States

psig—pounds per square inch gauge

QAE—Quality Assurance Evaluator

RPIE—Real Property Installed Equipment

USACERL—U.S. Army Construction Engineering Research Laboratory

USEPA—United States Environmental Protection Agency

Attachment 2**INSPECTION REQUIREMENTS****A2.1. Types of Inspections:****A2.1.1. Boilers:**

A2.1.1.1. Type A. Internal and external inspection.

A2.1.1.2. Type B. Internal and external inspection, followed or preceded by external inspection while boiler is under a hydrostatic test.

A2.1.1.3. Type C. External inspection while under steam pressure or filled with water.

A2.1.1.4. Type D. External inspection while under hydrostatic test.

A2.1.1.5. Type E. Internal and external inspection of expansion tanks with HTW boilers.

A2.1.2. Unfired Pressure Vessels:

A2.1.2.1. Type VA. Internal and external inspection.

A2.1.2.2. Type VB. Internal and external inspection, followed or preceded by external inspection while pressure vessel is under hydrostatic test.

A2.1.2.3. Type VC. External inspection while under operating conditions and pressure.

A2.1.2.4. Type VD. External inspection while under hydrostatic test.

A2.1.2.5. Type VE. Internal and external inspection with an ultrasonic thickness test of the pressure shell.

A2.2. Requirements:**A2.2.1. High Pressure Steam Boilers:**

A2.2.1.1. Accomplish a Type A inspection, including an internal and external inspection, annually.

A2.2.1.2. Perform a Type B inspection, which includes a hydrostatic test, every 3 years. This replaces the Type A inspection for that year.

A2.2.1.3. Accomplish a secondary inspection (Type C) annually, approximately 6 months after the Type A or B.

A2.2.2. High Temperature Water (HTW) Boilers:

A2.2.2.1. Perform an external (Type C) inspection once a year.

A2.2.2.2. Perform an internal inspection (Type A) after the first and second year of operation.

A2.2.2.3. Perform a Type E inspection on each expansion tank every two years. Perform a Type VC inspection during alternating years.

A2.2.3. Frequency of HTW Boiler Internal Inspections After 2 Years. After operating and inspecting the boiler for 2 years, extend the frequency of internal inspection to 3 years if:

A2.2.3.1. No adverse conditions such as scale or corrosion are present.

A2.2.3.2. The amount of makeup water is negligible.

A2.2.3.3. Effective chemical treatment is under strict control.

A2.2.4. Questionable Steam and HTW Boilers. Perform a Type B inspection when: (1) a boiler has been reinstalled; (2) a boiler had major repairs (as defined in the NBIC). Inspect before returning the boiler to normal operation. Perform a Type A inspection 6 months after resuming operation. Ensure an NBIC inspector performs a preliminary Type A or B inspection before initiating a major repair.

A2.2.5. Low Pressure Heating Boilers. Perform a Type C inspection on: (1) hot water heating boilers annually that operate at or below 121 °C (250 °F) and at or below 1103 kPa (160 psig); (2) low pressure steam boilers (below 103 kPa [15 psig]) twice annually. Only boilers less than 0.293 MW (1 MBtu/h) output that produce domestic hot water are exempt from this inspection requirement. Inspections do not require a certified inspector, and may be accomplished by experienced base or MAJCOM personnel.

A2.2.6. Compressed Air Receivers and Other Unfired Pressure Vessels. Perform a Type VE inspection every 3 years. When questionable conditions or inspection indicates that a safety problem exists:

A2.2.6.1. Conduct hydrostatic tests.

A2.2.6.2. Notify the MAJCOM by letter or E-mail of the vessel safety problem.

A2.2.6.3. Perform repairs as required.

A2.2.6.4. Perform a Type VE inspection annually until all problems are corrected.

A2.2.6.5. After inspection indicates problems are corrected, inspect every 3 years.

NOTE:

For pressure vessels that operate over 1379 kPa (200 psig) and cannot be inspected internally and externally, hydrostatically test to 1.5 times working pressure every 3 years.

A2.2.7. New Boilers. Perform a Type B inspection on all new boilers, steam or HTW, before operating them.

A2.2.8. Scheduling and Obtaining Inspection Services:

A2.2.8.1. Continental United States (CONUS) Bases. The MAJCOM ensures an inspection contract is in place and boilers and pressure vessels are scheduled for the required inspections. The central Air Force contract may be used. The MAJCOM coordinates with HQ AFCESA and notifies other MAJCOMs before initiating a separate contract proposal.

A2.2.8.2. Bases Outside the Continental United States (OCONUS). MAJCOMs serving bases in foreign countries must make sure that a boiler inspection program exists. Some host countries have their own boiler inspection program and may require the Base Civil Engineer to use their services. In other cases, the MAJCOM may use the CONUS inspection guidelines to establish a separate program. Bases in Alaska, Hawaii, Guam, other non-CONUS states, possessions, or territories and foreign countries also can use the services available to CONUS bases.

A2.2.9. Inspector Qualifications. The NBIC establishes basic qualifications for boiler inspectors in the United States, its territories, and possessions. Inspectors must hold a current National Board Commission. MAJCOMs must use the NBIC standards for bases in foreign countries if the host country does not have standards equal to NBIC's.

A2.2.10. Scheduled Inspections (CONUS Bases). The Base Civil Engineer schedules inspections according to one of two methods: (1) submits annual inspection requirements according to MAJCOM instructions; (2) confirms computer-generated schedules according to MAJCOM instructions.

A2.2.10.1. Unscheduled Inspections (CONUS Bases). If a boiler or pressure vessel requires an inspection and is not on the annual schedule, the Base Civil Engineer must request approval for the inspection. Submit request according to MAJCOM instructions.

A2.2.10.2. Special Inspections (CONUS Bases):

A2.2.10.2.1. Perform a special inspection (Type A or B) before starting repairs to pressure components. Perform an unscheduled Type B inspection when repairs to pressure components are complete. Arrange these special inspections through the MAJCOM. Perform a special inspection after a boiler failure with potential damage *or* explosion to determine the extent of damage or necessary repairs. Depending upon the boiler condition, you may need to conduct a loss analysis or useful life study. The host MAJCOM or base must fund special studies.

A2.2.10.2.2. If the company under contract cannot make a special or emergency inspection, the Base Civil Engineer may hire an authorized inspection agency. An installation employee must not make these special inspections.

A2.2.10.3. Special Inspections (U.S. Bases in Foreign Countries). MAJCOMs serving these bases must have qualified and competent boiler inspectors perform special inspections. (Base-level personnel must not supervise these inspectors.) The Base Civil Engineer must see that the inspecting agency sends a complete report on each boiler inspected to the MAJCOM.

A2.2.11. Hydrostatic Testing of Boilers:

A2.2.11.1. Establishing Test Conditions. During hydrostatic tests to determine tightness under Type B or D inspections:

A2.2.11.1.1. Remove safety valves before testing, or hold down each disc with a test clamp or plug device designed for this purpose.

A2.2.11.1.2. Ensure water temperature is not less than ambient, and between 21 °C and 49 °C (70 °F and 120 °F).

A2.2.11.1.3. Ensure test pressure is equal to boiler working pressure, but not greater than the set pressure of the safety device with the lowest setting.

NOTE:

For tests under a Type B inspection, externally inspect the boiler during the safety test at the pressure described above. Set test pressure for inspections of new boilers and existing boilers before and after repairs at 1.5 times the maximum allowable working pressure.

A2.2.11.2. When to Hydrostatically Test High Pressure Boilers. Subject high pressure boilers to hydrostatic tests only under specific conditions:

A2.2.11.2.1. Upon completion of installation (include this requirement in the construction contract as a contractor's responsibility).

A2.2.11.2.2. After completing major repairs to any boiler component subject to steam or water pressure.

A2.2.11.2.3. Before returning boilers to service in reactivated plants.

A2.2.11.2.4. When the boiler inspector, the facility or MAJCOM engineer recommends.

A2.2.11.2.5. At the frequency required in A2.2.